CS102A Fall 2021 Assignment 2

Problem 1. Calculating derivative

Description

A polynomial with *n* elements is as follows:

> $f(X) = a_0+a_1X^1+a_2X^2+...+a_{n-1}X^{n-1}$

Now, you are given a_0, a_1, ..., a_{n-1} and X, your task is to calculate the derivative f'(X).

Input

The program receives input from `System.in`.
The input consists of 3 lines.
The first line contains an integer $n(1 \leq n \leq 4)$, indicating the number of elements in the polynomial.
The second line has *n* integers, they are a_0, a_1, a_2, ..., a_{n-1}, where $-20 \leq a_i \leq 20$, for $i \in \{0, 1, 2, ..., n-1\}$.
The third line is a floating point number X satisfying $-10 \leq X \leq 10$.

Output

One line of floating point number f'(X), rounded to two decimal places after the decimal point.

Sample Input 1

```
4
0 1 2 3
10
```

Sample output 1

```
941.00
```

Sample Input 2

```
3
-20 0 10
1.55
```

Sample Output 2

> 31.00

Hint

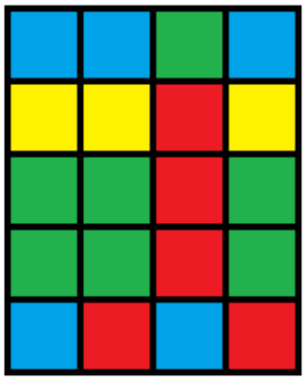
In the first example, f(x) = 0 + 1x + $2x^2$+$3x^3$. Its derivative is f'(x) = 1 + 4x+$9x^2$. And X is 10. So f'(10) = 1 + 4x10 + $9x10^2$ = 941.

In the second example, f(x) = -20 + 0x + $10x^2$. Its derivative is f'(x) = 20x. Finally, f'(1.55) = 31.

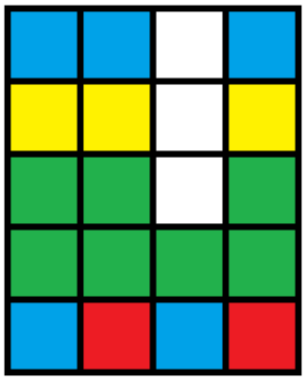
Problem 2. Match-3 game

In this problem, you are required to solve a match-3 game (连连看，或三消).

You are given a two dimensional graph for a verticle rectangle area like the following:

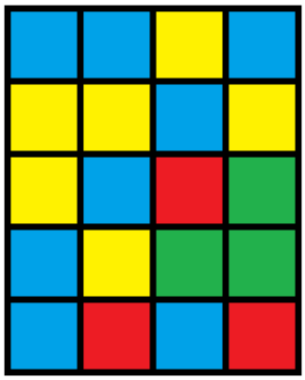


We can see that there are three red blocks stay together. This is a match. So they should disappear as follows:



As the 3 red blocks disappear, the green one on the top fell and three empty spaces were left.

You are required to tell whether there is at least one match in the graph. Note that a match means three or more consecutive blocks form either a horizontal line or a verticle line. The following graph contains **No** match:



In order to simplify the input, you won't be given image files to process. We will use numbers 1, 2, 3, 4 to represent red, green, blue and yellow.

Input

The program receives input from standard input.
The first line contains two integers H and W, meaning the height and width of the graph. $3 \leq H \leq 100$, $3 \leq W \leq 100$.

Then H lines follows, each line contains W integers, the integers always in {1, 2, 3, 4}, indicating the color of the block at the corresponding place.

Output

One line of the result. "Yes" means there is at least one match in the graph. "No" means no match on the graph. Without quote.

Sample Input 1

```
5 4
3 3 2 3
4 4 1 4
2 2 1 2
2 2 1 2
3 1 3 1
```

Sample output 1

```
Yes
```

Sample Input 2

```
5 4
3 3 4 3
4 4 3 4
4 3 1 2
3 4 2 2
3 1 3 1
```

Sample Output 2

```
No
```

Hint

In the first sample, we can see three "1"s forming a verticle line, it is a match. In the second example, there is no such match.

Problem 3. Looking for pairs

You are given an array of N ($1 \leq N \leq 10000$) integers. The ith integer is denoted as a_i ($-10000 \leq a_i \leq 10000$). Your task is to find how many pairs a_i, a_j are there in the array such that $a_i+a_j = 0$ and $i < j$.

Input

The input contains multiple test cases.

The first line contains an integer T ($1 \leq T \leq 10$), the number of test cases. Then T test cases follows.

In each test case, the first line contains a integer N indicating the size of the array. The next line contains N integers as a_i.

Output

For each test case, output one line, the number of pairs described above in the array.

Sample Input

```
3
5
-2 -1 0 1 2
6
-1 -1 -1 1 1 1
1
1
```

Sample output

```
2
9
0
```

Hint

In the first test case, the array is {-2, -1, 0, 1, 2}, there are two pairs {-2, 2}, {-1, 1} sums to 0.

In the second case, the array is {-1, -1, -1, 1, 1, 1}, in order to choose a pair, you have to choose between three -1s and three 1s, that is 3x3=9 choices.

In the third case, there is only {1} in the array, there is no pair.

Problem 4. Counting Available Tickets

Description

There is a one way road with n bus stations. The first station's index is 0. Their is a bus on the road with m seats for passengers, meaning that it can sell m tickets in the starting station. Currently, p tickets are already sold. For each ticket p_i, it is from station s_i and to station d_i.

Now, Gary and his class are going to travel from station a to station b. He wants to know the number of available tickets left, that is, your program should output the correct t for him.

Input

The program receives input from `System.in`.
The input consists of $(p+2)$ lines.
The 1st line contains the integer n ($2 \leq n \leq 100$), the integer m ($2 \leq n \leq 100$) and the integer p ($2 \leq n \leq 300$).
The 2nd line to the ($p+1$)th row have two integers, in the format as follows:
s_1, d_1
s_2, d_2
...
s_p, d_p
The ($p+2$)th row are a and b, repectively.

Output

The integer t.

Sample Input 1

```
5 10 3
0 3
1 2
3 4
1 3
```

Sample output 1

```
8
```

Sample Input 2

```
6 5 5
1 4
2 3
1 5
0 3
2 5
0 5
```

Sample Output 2

```
0
```

Hint

In Sample Input 1, there are 5 stations here and 10 tickets are sellable at the begining. The first passenger gets on the bus at the 0th station and gets off at the 3rd station. Similarily, both the 2nd and the 3rd passengers get on at the 1st station while get off at the 2nd and 4th station, respectively. From the 1st station and 3rd station, 8 tickets are avaliable because the 1st and 2nd passengers are in the bus. Likewise, you can deduce that no ticket can be sold in the case of Sample Input 2.

Problem 5. Schedule Routine

Description

As a college student, we have to finish our work every day. How to schedule our routine between reading paper, finishing assignments and project is important. In this question, we suppose that each paper cost **2** time units, each assignment cost **3** time units and each project cost **5** time units. Also, game hours are needed to balance. Every day one student has `m` time units and `n`(`m, n` will be given) time units for rest(the time besides game and work). Please calculate the game hours the student can get every day. Also, please calculate the average game hours and tell us how many days are above the average.

Input

The program receives input from `System.in`. The input consists of multiple lines. The first line contains an integer *T*(1 $\leq T \leq$ 100), indicating the number of test cases in all. For next T parts, in each part, the first line contains three integers which are `l`, `m` and `n`. `l` stands for how many days in this part and $1 \leq l \leq 5000$. `m` shows that every day contains `m` time units, $20 \leq m \leq 100$. `n` time units will be used for rest. The second line contains $3l$ integers which shows **the number of papers, assignments and projects every day in order**(means paper, assignment, project, paper, assignment, project...).
It's guaranteed that work hours and rest hours will not exceed the daily time units.

Output

The output will be $2T$ lines. For each parts there are two lines which are game hours every day and number of day above the average.

Sample Input 1

```
1
3 24 8
0 0 0 1 0 0 1 2 1
```

Sample output 1

```
16 14 3
2
```

Sample Input 2

```
1
3 100 20
38 0 0 39 0 0 40 0 0
```

Sample Output 2

```
4 2 0
1
```

Sample Input 3

```
1
8 30 10
1 0 0 1 0 0 2 0 0 3 0 0 1 0 0 2 0 0 3 0 0 4 0 0
```

Sample Output 3

```
18 18 16 14 18 16 14 12
5
```

Hint

All you need to do is to read the instructions and find ways to record the information you need in code form. Then operate on the information.

For example, input 3, there are 1 test case, which is that there are 8 days. Every day contains 30 time units and 10 time units are used for rest. Thus, there are 20 time units for game and work. For day 1 & day 2, there is 1 paper and no assignment or project. For day 3, there are 2 papers and no assignment or project.... Now you can calculate the game hours when you get the information every day.

After calculating, list work hours every day and average. Take sample input 3 as example, the work hours are `18 18 16 14 18 16 14 12`, average is 15.75. Then there are 5 days above the average.